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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/931,252	08/17/2001	Takashi Yano	520.40478X00	1490

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EXAMINER	
LAMARRE, GUY J	

ART UNIT	PAPER NUMBER
2133	

DATE MAILED: 04/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/931,252	YANO ET AL.	
	Examiner	Art Unit	
	Guy J. Lamarre, P.E.	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *7 Oct. 2004* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *24 March 2004* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

0. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection on ***7 Oct. 2004*** Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission, filed 8 Aug. 2004, has been entered.

1. This office action is in response to such Applicants' Amendment/submission.

1.1 Claims 1, 5-6 are amended. Claims 1-6 remain pending.

1.2 The objections and rejections of record are withdrawn in response to Applicants' amendment.

Response to Arguments

1.3 Applicants' arguments have been fully considered and they are deemed persuasive only to the extent that **FREEMAN** (EP No. 973292A2; January 19, 2000) does not specifically detail soft iteration termination of the decoding process. However, such soft coding iteration termination approach is disclosed in **Schurgers et al.** "*Adaptive turbo decoding for indoor wireless communication*; 1998 URSI International Symposium on Signals, Systems, and Electronics, ISSSE 98, pp: 107-111; 2 Oct 1998," as follows.

Claim Rejections - 35 USC § 103

2. Claim(s) 1-4 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over FREEMAN et al. (EP No. 973292A2; January 19, 2000) in view of **Schurgers et al.** "*Adaptive turbo decoding for indoor wireless communication*;" 1998 URSI International Symposium on Signals, Systems, and Electronics, ISSSE 98, pp: 107-111; 2 Oct 1998.

As per claim 1, FREEMAN substantially teaches, in Fig. 5 and related description, turbo decoder means for application of input turbo-encoded data; of repeatedly carrying out turbo

decoding a number of times to restore the originally transmitted data; of judging the reliability of the soft outputted decoded result from statistics of the soft output result; of calculating the root mean square (a statistical measure) of the soft output and comparing (or judging) the result; of controlling the number of iterations to run based on the judgment result; of repeating the turbo decoding in accordance with the comparison result of the root mean square. Hence FREEMAN teaches of controlling the number of iterations (repetitions) based on the judgment result.

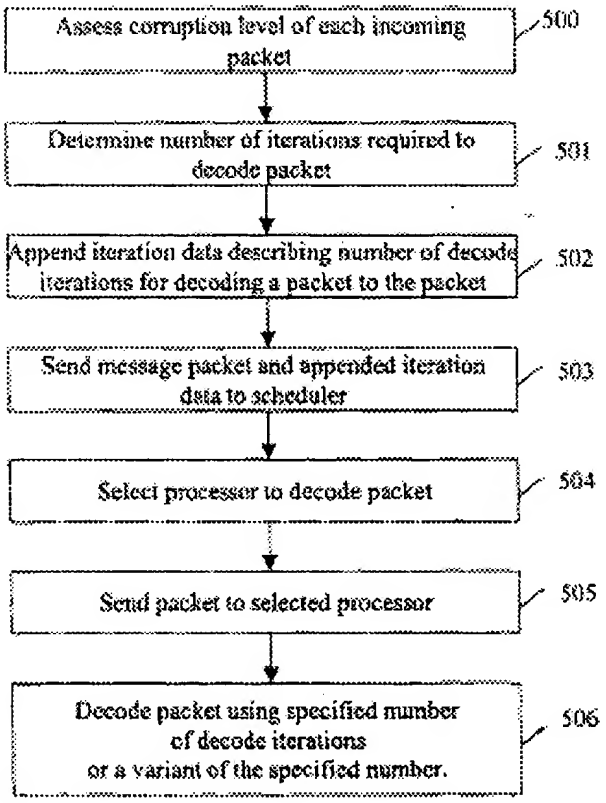

Fig. 5

FREEMAN does not explicitly teach of using the turbo encoding to correct errors.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use turbo-encoded data to help correct errors. It would have been obvious

to one of ordinary skill because it is well known that error-correcting codes (such as turbo codes) are used to help detect and/or correct errors in transmitted data.

While FREEMAN et al. substantially disclose the procedure for the claimed method or apparatus, they **fail to specifically mention** that soft coding iteration termination is effected.

However Schurgers et al., in an analogous art, discloses such soft coding iteration termination algorithms in "*Adaptive turbo decoding for indoor wireless communication,*" e.g., **Schurgers et al.** discloses an "*Adaptive turbo decoding,*" e.g., in Fig. 8 and Tables 1-2, performing an equivalent functionality for turbo decoding based on channel information and characteristics. Fig. 1 shows plural wireless stations forming a communications networks, which stations transceive data under different channel attenuation characteristics, e.g., bit error rate, or various signal-to-noise ratios or various signal-to-interference ratios, such as, ratio of pilot channel transmission signal to pilot channel reception signal, as depicted by Fig. 2.

Figs. 3-5 lay the turbo coding background for mitigating the debilitating effects of such noisy channels wherein decoding is based on a fixed number of iterations.

Fig. 6 shows that, after a certain number of iterations, a point of diminishing return is reached whereby additional iterations do not significantly improve a decoding solution.

Sections 4-5 and Fig. 8 render obvious the claimed invention whereby a decoding algorithm transforms the fixed number of iterations of a conventional turbo code into an adaptive iterative process by incorporation of termination criteria, e.g., based on channel fading parameters. Based on a ratio of transmitted signal power or energy, viz., E_B to channel additive white Gaussian noise power N_0 on page 110: col. 2 last sentence and Table 2.

Briefly, when the signal to noise ratio is large, a reflection of good channel characteristics, the number of decoding iterations is accordingly reduced. When the signal to noise ratio is low, i.e., below a preset threshold, indicative of poor channel characteristics, the

number of decoding iterations is increased. Dynamically adapting the iterative process considerably reduces transmission-decoding power consumption when signal attenuation is negligibly low under good channel conditions as described in **Section 6** of page 111.

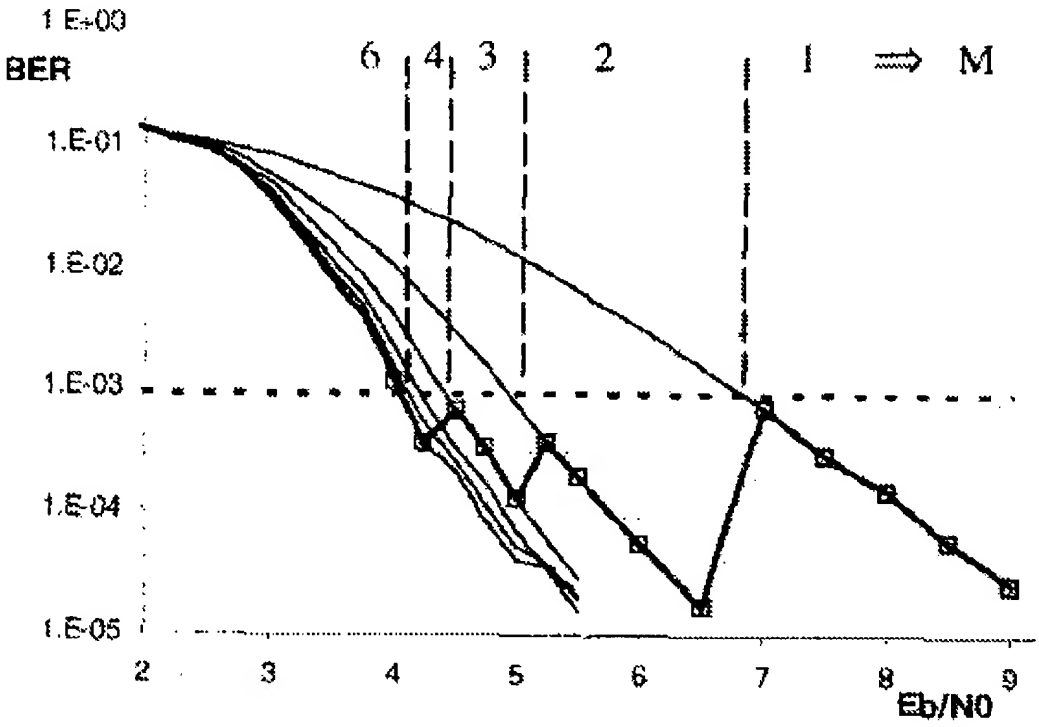

Figure 8: Performance with an acceptable BER of 10^{-3} for rate ½ turbo code, K=512, 4 states, fading channel

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the procedure of **FREEMAN et al.** by including therein adaptive iterative process by incorporation of decoding termination criteria as taught by **Schurgers et al.**, because such modification would provide the procedure disclosed in **FREEMAN et al.** with a technique whereby communications system energy/power consumption is optimized.

As per claim 2, FREEMAN, as noted above in claim 1, substantially teaches the limitations of claim 2. With respect to the limitations of claim 2, FREEMAN teaches of a signal-to-noise ratio estimation section used to estimate the signal-to-noise ratio of data on the basis of reliability information from the decoding section. The limitations of claim 2 are, as disclosed on page 9 of the specifications, comparing the signal power and noise power of a decoded data. With this in mind, the Examiner is reading the teachings of FREEMAN to teach of comparing signal and noise power (as a ratio) and using the outcome of the comparison to carry out the repetition of the turbo decoding, e.g., at paras. 6-9.

As per claim 3, FREEMAN, as noted above in claim 1, substantially teaches the limitations of claim 3. With respect to the limitations of claim 3, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the comparison of the mean and minimum values of the soft output decoder as judging means. The limitations of claim 3 are comparing the minimum and the mean (average) values of the soft output decoder. It would have been obvious to one of ordinary skill in the art to use the observed mean and minimum values to help determine if further iterations/repetitions would be required. By comparing the minimum value and the mean (or average) value, one of ordinary skill would be able to determine how close or far the two values are from each other. If, for instance, the observed minimum value were much less than the mean value, then it would be obvious to one of ordinary skill that the reliability would be low and therefore would require more iterations. Further, if as described in figure 5 of the specifications, the minimum value multiplied by a constant was less than the mean, it is clear that the minimum value is (still) much smaller than the mean. Conversely, if the minimum value multiplied by a constant was greater than the mean, it would imply that the minimum value is closer, relatively speaking, to the mean value and hence have a higher reliability and not require more iterations.

As per claim 4, FREEMAN, as noted above in claim 1, substantially teaches the limitations of claim 4. With respect to the limitations of claim 4, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the comparison of the maximum and minimum values of the soft output decoder as judging means. The limitations of claim 4 are comparing the maximum and minimum values of the soft output decoder. It would have been obvious to one of ordinary skill in the art to use the observed maximum and minimum values to help determine if further iterations/repetitions would be required. By comparing the maximum and minimum values, one of ordinary skill would be able to determine how far apart or close to each of the extreme values of the decoder are to one another. Obviously, the maximum value will always be greater than the minimum, but the use of their difference or ratio can be used to determine how close or far the two values are from each other. If, as described in figure 6 of the specifications, the minimum value multiplied by a constant were compared to the maximum value, it would have been obvious that if the min. value times the constant were greater than the maximum value, then the two values are relatively close and would require fewer, if any, extra iterations.

2.1 Claim(s) 5 and 6 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over FREEMAN and **Schurgers et al.** in view of Dissosway et al. U.S. Patent No. 4,903,262 (hereinafter Dissosway).

As per claims 5 and 6, FREEMAN and **Schurgers et al.** substantially teach of a turbo decoder that decodes turbo encoded data in Fig. 5 of judging the reliability of the soft outputted decoded result from statistics of the soft output result and of controlling the number of iterations to run based on the judgment result.

FREEMAN and **Schurgers et al.** do not teach of the turbo decoder being part of a transmitter/receiver in a mobile communication system. Nonetheless, FREEMAN and

Schurgers et al. do teach of turbo codes being used in mobile communications to help improve error correcting ability in the transmission path.

Dissosway, in an analogous art, teaches of radio frequency circuit for transmitting and receiving radio frequency signals, a digital signal processor and a receiver (as part of the transceiver (transmitter-receiver), see column 31, claim 17, lines 15-25.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the turbo receiver of FREEMAN **and** Schurgers et al. to the transceiver Dissosway. This modification would have been obvious because one of ordinary skill in the art would have been motivated by the suggestion provided by FREEMAN **and** Schurgers et al. to use turbo encoders and decoders to help improve the error correcting ability of the communication path of mobile communication systems (or the like), see page 1, paragraph 2. Clearly, from the abstract of Dissosway, the system of Dissosway is a mobile communication system with mobile transceivers and mobile terminals.

Conclusion

3. Any response to this action should be mailed to:

Commissioner of Patents and Trademarks, Washington, D.C. 20231

or faxed to: (703) 872-9306 for all formal communications.

Hand-delivered responses should be brought to Customer Services, 220 20th Street S., Crystal Plaza II, Lobby, Room 1B03, Arlington, VA 22202.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Guy J. Lamarre, P.E., whose telephone number is (571) 272-3826. The examiner can normally be reached on Monday to Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert De Cady, can be reached at (571) 272-3819.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (571) 272-3609.

Information regarding the status of an application may also be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Guy J. Lamarre, P.E
Primary Examiner
4/4/05